



HEIDENHAIN



Product Information

ECI 1119 **EQI 1131**

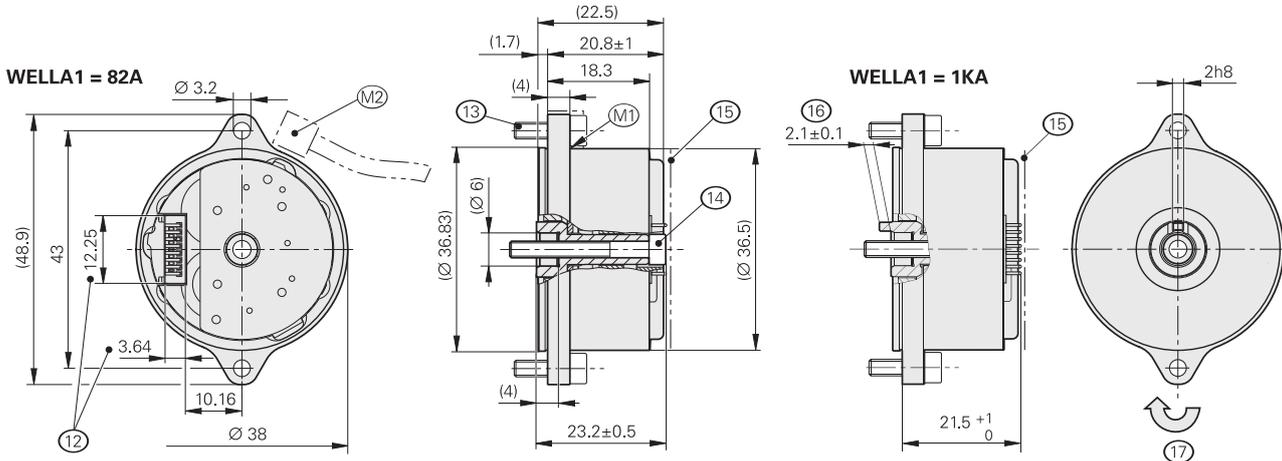
Absolute Rotary Encoders without
Integral Bearings

Suited for safety-related
applications up to SIL 3 when
coupled with additional measures

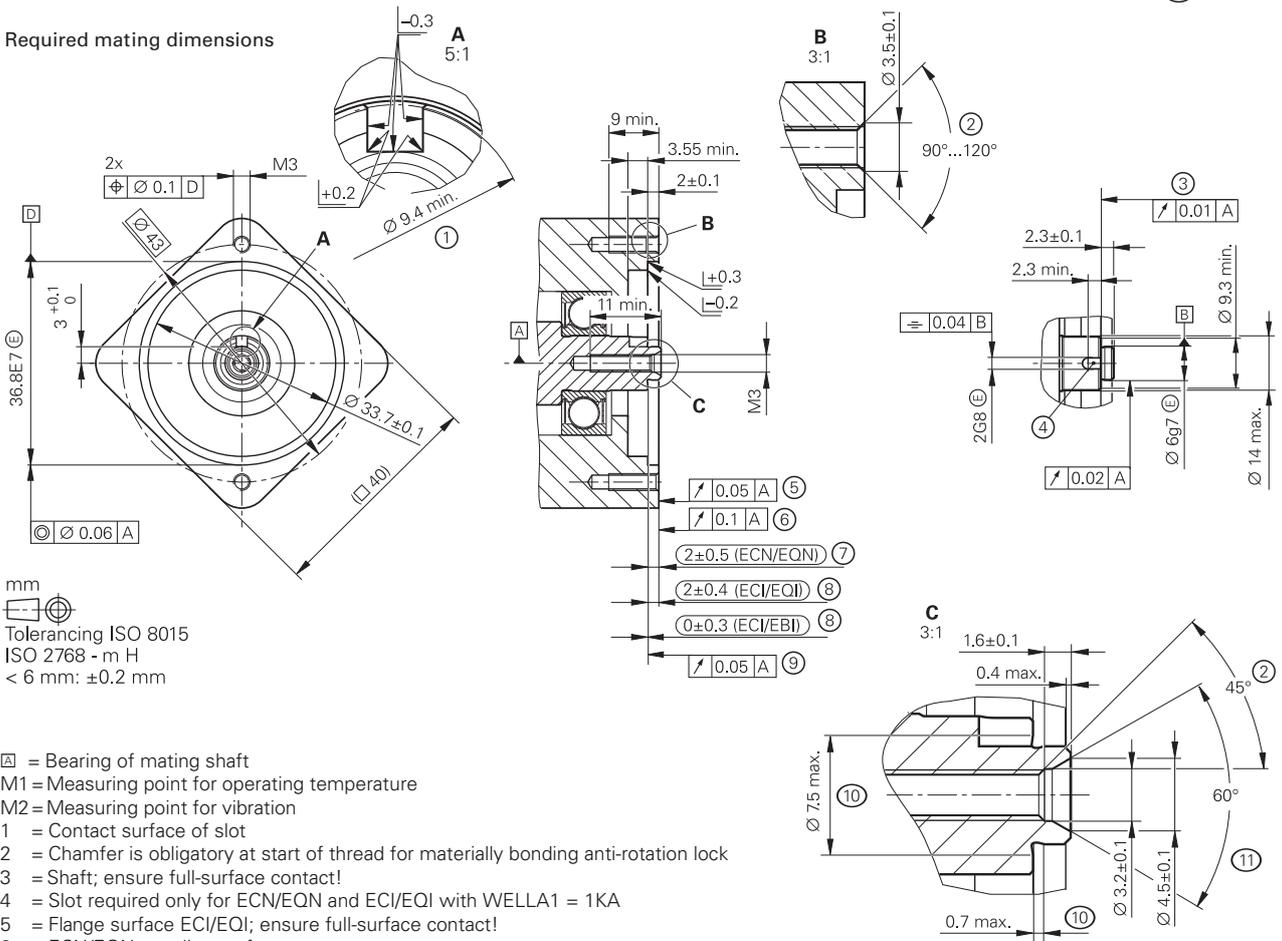
ECI 1119, EQI 1131

Rotary encoders for absolute position values with safe singleturn information

- Rugged inductive scanning principle
- Mounting-compatible to photoelectric rotary encoders with 75A stator coupling
- 70C mounting flange
- Ø 6 mm blind hollow shaft for axial clamping with positive lock (1KA) or without (82A)
- Required mating dimensions with M3x30 central screw and version for customer cost optimization upon request



Required mating dimensions



mm
 Tolerancing ISO 8015
 ISO 2768 - m H
 < 6 mm: ±0.2 mm

- ⊠ = Bearing of mating shaft
- M1 = Measuring point for operating temperature
- M2 = Measuring point for vibration
- 1 = Contact surface of slot
- 2 = Chamfer is obligatory at start of thread for materially bonding anti-rotation lock
- 3 = Shaft; ensure full-surface contact!
- 4 = Slot required only for ECN/EQN and ECI/EQI with WELLA1 = 1KA
- 5 = Flange surface ECI/EQI; ensure full-surface contact!
- 6 = ECN/EQN coupling surface
- 7 = Maximum permissible deviation between shaft and coupling surfaces. Compensation of mounting tolerances and thermal expansion, for which ±0.15 mm of dynamic axial motion is permitted
- 8 = Maximum permissible deviation between shaft and flange surfaces. Compensation of mounting tolerances and thermal expansion
- 9 = ECI/EBI flange surface; ensure full-surface contact!
- 10 = Undercut
- 11 = Possible centering hole
- 12 = Opening for plug connector min. 1.5 mm larger all around
- 13 = Screw ISO 4762 - M3x10 - 8.8 - MKL, tightening torque 1±0.1 Nm
- 14 = Screw ISO 4762 - M3x25 - 8.8 - MKL, tightening torque 1±0.1 Nm
- 15 = Maintain a distance of at least 1 mm to the cover. Ensure opening for the connector!
- 16 = Positive-locking element. Ensure correct engagement in slot 4
- 17 = Direction of shaft rotation for output signals as per the interface description

Specifications	ECL 1119 – Singleturn	EQI 1131 – Multiturn
These data apply for	<i>Shaft 1KA</i> : ID 826930-01/-51 ¹⁾ <i>Shaft 82A</i> : ID 826930-02/-52 ¹⁾	<i>Shaft 1KA</i> : ID 826980-01/-51 ¹⁾ <i>Shaft 82A</i> : ID 826980-02/-52 ¹⁾
Functional safety For applications up to	As single-encoder system for monitoring and closed-loop functions <ul style="list-style-type: none"> SIL 2 according to EN 61508 (further basis for testing: EN 61800-5-2) Category 3, PL d according to EN ISO 13849-1:2008 <p>With additional measures as per document 1000344 for safety-related applications up to SIL 3 or category 4, PL e Safe in singleturn range</p>	
PFH	<i>SIL 2</i> : $\leq 15 \times 10^{-9}$ (probability of dangerous failure per hour) <i>SIL 3</i> : $\leq 2 \times 10^{-9}$	
Safe position ²⁾	<i>Encoder</i> : $\pm 0.88^\circ$ (safety-related measuring step SM = 0.35°) <i>Mechanical coupling for shaft 82A</i> : $\pm 0^\circ$; <i>for shaft 1KA</i> : $\pm 2^\circ$ (fault exclusion for loosening of shaft and stator coupling, designed for accelerations on stator of: $\leq 400 \text{ m/s}^2$; on the rotor of: $\leq 600 \text{ m/s}^2$)	
Interface	EnDat 2.2	
Ordering designation	EnDat22	
Position values/revolution	524 288 (19 bits)	
Revolutions	-	4096 (12 bits)
Calculation time t_{cal} Clock frequency	$\leq 5 \mu\text{s}$ $\leq 16 \text{ MHz}$	
System accuracy	$\pm 120''$	
Electrical connection	15-pin PCB connector (with connection for external temperature sensor ³⁾)	
Cable length	$\leq 100 \text{ m}$ (see EnDat description in the <i>Interfaces of HEIDENHAIN Encoders</i> catalog)	
Voltage supply	3.6 V DC to 14 V	
Power consumption ⁴⁾ (maximum)	<i>At 3.6 V</i> : $\leq 650 \text{ mW}$; <i>At 14 V</i> : $\leq 700 \text{ mW}$	<i>At 3.6 V</i> : $\leq 750 \text{ mW}$; <i>at 14 V</i> : $\leq 850 \text{ mW}$
Current consumption (typical)	<i>At 5 V</i> : 95 mA (without load)	<i>At 5 V</i> : 115 mA (without load)
Shaft*	Blind hollow shaft for axial clamping, $\varnothing 6 \text{ mm}$ without positive-locking element (82A) or with (1KA)	
Spindle speed	$\leq 15\,000 \text{ min}^{-1}$	$\leq 12\,000 \text{ min}^{-1}$
Moment of inertia of rotor	$0.3 \times 10^{-6} \text{ kgm}^2$	
Angular acceleration of rotor	$\leq 1 \times 10^5 \text{ rad/s}^2$	
Axial motion of measured shaft	$\leq \pm 0.4 \text{ mm}$	
Vibration 55 to 2000 Hz ⁵⁾ Shock 6 ms	<i>Stator</i> : $\leq 400 \text{ m/s}^2$; <i>rotor</i> : $\leq 600 \text{ m/s}^2$ (EN 60 068-2-6) $\leq 2000 \text{ m/s}^2$ (EN 60 068-2-27)	
Operating temperature	-40 °C to 110 °C	
Threshold sensitivity Error message for exceeded temperature	125 °C (measuring accuracy of the internal temperature sensor: $\pm 1 \text{ K}$)	
Relative humidity	$\leq 93 \%$ (40 °C/21 d as per EN 60 068-2-78); without condensation	
Protection EN 60 529	IP 00 (see <i>Insulation</i> under <i>General mechanical information</i> in the <i>Encoders for Servo Drives</i> catalog; ensure CE conformity of the overall system through installation measures!)	
Weight	$\approx 0.04 \text{ kg}$	

* Please select when ordering

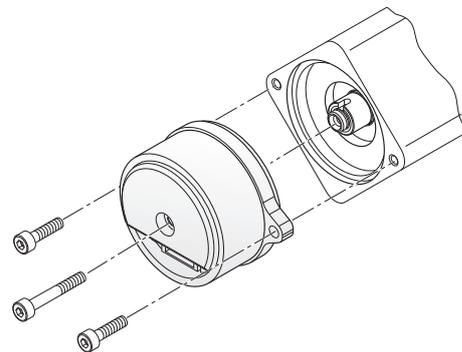
- 1) Rotary encoders in a collective package
- 2) Further tolerances may occur in subsequent electronics after position value comparison (contact manufacturer of subsequent electronics)
- 3) See *Temperature measurement in motors* in the *Encoders for Servo Drives* catalog
- 4) See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* catalog
- 5) 10 Hz to 55 Hz, constant over distance, 4.9 mm peak to peak

Mounting

The blind hollow shaft of the rotary encoder is slid onto the motor's drive shaft and fastened with a central screw. For the 1KA encoder shaft it is particularly important to ensure that the positive lock securely engages the corresponding slot in the measured shaft. The stator is mounted by a centering diameter with two mounting screws. Screws with materially bonding anti-rotation lock are to be used (see *Mounting accessories*).

Conditions required on the motor side for a safe mechanical connection:

	Mating shaft	Mating stator
Material	Steel	Aluminum
Tensile strength R_m	$\geq 600 \text{ N/mm}^2$	$\geq 220 \text{ N/mm}^2$
Shear strength τ_m	-	$\geq 150 \text{ N/mm}^2$
Interface pressure P_G	$\geq 500 \text{ N/mm}^2$	$\geq 200 \text{ N/mm}^2$
Surface roughness R_z	$\leq 10 \mu\text{m}$	$\leq 10 \mu\text{m}$
Coefficient of thermal expansion α_{therm}	$(10 \text{ to } 17) \times 10^{-6} \text{ K}^{-1}$	$\leq 25 \times 10^{-6} \text{ K}^{-1}$



Mounting accessories

Screws

Screws (mounting screws, central screws) are not included in delivery. They can be ordered separately. The screws from HEIDENHAIN feature a coating as per DIN 267-27 which, after hardening, provides a materially bonding anti-rotation lock. For this reason the screws cannot be reused. Unused screws are not storable indefinitely. The minimum shelf life is 2 years (storage at $\leq 30 \text{ }^\circ\text{C}$ and $\leq 65 \%$ relative humidity). The expiration date is printed on the package.

ECI 1119; EQI 1131	Screws ¹⁾		Lot size
Central screw for fastening the shaft	ISO 4762-M3×25-8.8-MKL	ID 202264-86	10 or 100 pieces
Mounting screw for flange	ISO 4762-M3×10-8.8-MKL	ID 202264-87	20 or 200 pieces

1) With coating for materially bonding anti-rotation lock

Please note: The adhesive on the screws with materially bonding coating hardens quickly. Screw insertion and application of tightening torque must therefore take no longer than 5 minutes (see dimension drawing). The required strength is attained after 6 hours at room temperature. The curing time increases with decreasing temperature. Curing temperatures below $5 \text{ }^\circ\text{C}$ are not permissible.

Mounting aid for engaging and disengaging the PCB connector. The mounting aid prevents damage to the cable because it applies the pulling force solely to the connector. Tension must not be applied to the wires.

ID 1075573-01

For further mounting information and mounting aids see the *Mounting Instructions* and the *Encoders for Servo Drives* catalog. The installation can be inspected with the PWM 20 and ATS software (see document *1082415*)



Integrated temperature evaluation

This rotary encoder features a temperature sensor integrated in the encoder electronics and an evaluation circuit for an external temperature sensor. In both cases, the respective digitized temperature value is transmitted purely serially over the EnDat protocol. It must be noted in both cases that temperature measurement and transmission is not "safe" in the sense of functional safety.

With regard to the internal temperature sensor, the rotary encoder supports a dual-level cascaded signaling of exceeded temperature. It consists of an EnDat warning and an EnDat error message.

In accordance with the EnDat specification, when the warning threshold of the internal temperature sensor is reached, an EnDat warning is transmitted (EnDat memory area "operating status," word 1 – "warnings," bit 2¹ – "temperature exceeded"). This warning threshold for the internal temperature sensor is saved in the EnDat memory area "Operating parameters," word 6 – "trigger threshold" of the warning bit for "excessive temperature," and can be individually adjusted. A device-specific default value is saved here when the encoder is shipped. The temperature measured by the internal temperature sensor is higher by a device-specific and application-specific amount than the temperature at the measuring point M1 according to the dimension drawing.

The rotary encoder features a further, but nonadjustable, trigger threshold for the EnDat error message "temperature exceeded" of the internal temperature sensor which, when triggered, transmits an EnDat error message (EnDat memory area "operating status," word 0 – "error messages," bit 2² – "position," and in the additional datum 2 "operating status error sources", bit 2⁶ – "temperature exceeded"). This trigger threshold depends on the encoder model and is shown in the specifications.

Depending on the application, HEIDENHAIN recommends adjusting the threshold sensitivity so that it lies below the trigger threshold for the EnDat error message "temperature exceeded" by a sufficient value. Compliance with the permissible operating temperature with respect to the measuring point M1 is definitive for the intended use of the encoder.

Electrical connection – cables

Cables

Cables inside the motor housing Ø 4.5 mm;			
Complete with PCB connector (15-pin) and M12 flange socket (male), 8-pin; wires for temperature sensor		TPE 10×0.14 mm ² 1)	ID 746795-xx
Complete with PCB connector (15-pin) and M12 flange socket (male) 8-pin		TPE 8×0.14 mm ² 1)	ID 804201-xx

1) Single wires with braided sleeving; shield must be connected on the motor

Note for safety-related applications: Provide bit error rate as per specification 533095!

PUR connecting cable PUR Ø 6 mm; [(4×0.4 mm ²) + (4×0.34 mm ²)]; A _P = 0.34 mm ²		
Complete with M12 connector (female) and M12 coupling (male), both with 8 pins		ID 368330-xx
Complete with 8-pin M12 connector (female) and 15-pin D-sub connector (female)		ID 533627-xx
Complete with M12 connector (female), 8-pin and sub-D connector (male), 15-pin		ID 524599-xx
With one M12 connector (female), 8-pin		ID 634265-xx 1)

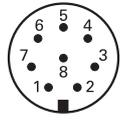
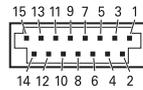
A_P: Cross section of power supply lines

1) Connecting element must be suitable for the maximum clock frequency used

Note for safety-related applications: Provide bit error rate as per specification 533095!

Electrical connection – pin layout

Pin layout

8-pin coupling or flange socket M12		Voltage supply				Position values				Other signals ¹⁾	
											
											
											
	8	2	5	1	3	4	7	6	/	/	
	13	11	14	12	7	8	9	10	5	6	
	U_p	Sensor U_p	0 V	Sensor 0 V	DATA	DATA	CLOCK	CLOCK	T⁺ ²⁾	T⁻ ²⁾	
	Brown/ Green	Blue	White/ Green	White	Gray	Pink	Violet	Yellow	Brown	Green	

1) Only with adapter cables inside the motor

2) Connections for external temperature sensor; evaluation optimized for KTY 84-130 (see *Temperature measurement in motors* in the *Encoders for Servo Drives* catalog)

Cable shield connected to housing; **U_p** = Power supply

Sensor: The sensor line is connected in the encoder with the corresponding power line

Vacant pins or wires must not be used!

Note for safety-oriented applications: Only HEIDENHAIN cables complete with connectors are qualified for use. Exchange connectors or modify cables only after consultation with HEIDENHAIN Traunreut.

HEIDENHAIN

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This Product Information supersedes all previous editions, which thereby become invalid. The basis for ordering from HEIDENHAIN is always the Product Information valid when the contract is made.

Related documents: Adhere to the information in the following documents to ensure the correct and intended operation of the encoder:

- Catalog *Encoders for Servo Drives* 208922-xx
- Mounting Instructions: *ECI 1119, EQI 1131* 1082414-xx
- Technical Information: *Safety-Related Position Measuring Systems* 596632
- For implementation in a safe control or inverter: Specification: 533095 and *supplementary catalog of measures (SIL 3, PL e)* 1000344